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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER
MASKULINSKI, MICHAEL C

ART UNIT	PAPER NUMBER
2184	14

DATE MAILED: 05/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/479,146	FULD, STEPHEN	
	Examiner	Art Unit	
	Michael C Maskulinski	2184	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 April 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *12-14 and 16-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *12-14 and 16-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *07 April 2003* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Final Rejection

Status of the Office Action mailed on March 18, 2003

1. The Office Action mailed was a Non-Final Office Action. A mistake was made on the Office Action Summary, form 326.

Drawings

2. The corrected or substitute drawings were received on April 7, 2003. These drawings are accepted by the Examiner.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 12-14 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stolowitz, U.S. Patent 6,018,778, and further in view of White, How Computers Work.

Referring to the limitation "the storage elements are magnetic tape drives or a track of a magnetic tape" of claims 12 and 16, in the Abstract, Stolowitz discloses a disk drive array. Further, in Figure 5, Stolowitz discloses a multiplexer (510) for changing the data from a parallel state to a serial state. However, Stolowitz doesn't explicitly disclose a magnetic tape having data blocks and a parity block in which the data blocks and the parity block are serially arranged on the magnetic tape with the parity block following the data blocks and the parity block being based on the data blocks. On

pages 176-177, White discloses that the format of a QIC tape typically contains 20 to 32 parallel tracks. Each track is divided into blocks of 512 or 1,024 bytes, and segments typically contain 32 blocks. Of the blocks in a segment, eight contain error-correction codes. These tracks comprise both data and parity. It would have been obvious to one of ordinary skill at the time of the invention to use a magnetic tape in the redundant storage system of Stolowitz. A person of ordinary skill in the art would have been motivated to make the modification because in column 8, lines 32-33, Stolowitz discloses the use of a serial stream when reading from the disk drives which is necessary for a tape drive. Thus there is a means for changing parallel data from the disks to serial data. The serial data from a tape would also be able to be inputted into the system of Stolowitz. Further, on pages 12-13 and in Figure 5, the Applicant discloses that an obvious variation of the magnetic tape drive is an array of disks. Specifically, on page 13, lines 5-7, the Applicant discloses that *controller 18 writes to and reads from storage elements in the same manner as described with reference to the track of magnetic tape 14 in FIG. 3.* Also, the system of Stolowitz is compatible with a tape disk drive because it contains a SCSI bus, which is a common interface for devices such as CD-ROM, drives and backup tape drives as well as hard disks (see column 4, lines 15-17).

Referring to the remaining limitations in claims 12 and 16:

a. On page 176, White discloses that of the blocks in a segment, eight contain error correction codes (the parity block following the data block).

b. In the Abstract, Stolowitz discloses a disk drive array with parity data based upon data blocks and a disk drive array controller that carries out disk drive data transfers.

c. In column 6, lines 20-22, Stolowitz discloses methods and circuitry for effecting synchronous data transfer to and from an array of disk drives (reading blocks sequentially from respective data storage elements).

d. In column 8, lines 42-44, Stolowitz discloses reconstructing missing data in the event of any single drive failure. Further, in column 8, lines 32-37, Stolowitz discloses that missing data is reconstructed as the serial stream of read data moves from the drives into the buffer. Only, complete, correct data is stored into the buffer according to the invention. No delay is incurred in the process. Hence a bad sector (corrupted or unreadable) or even an entire bad drive causes no special read delay (determining if the data block currently being read is good or bad based on the reading of the data block currently being read).

e. In column 8, lines 42-44, Stolowitz discloses that the serialized read data stream is passed through an N+1 stage pipeline register—data being entered shifts old data out (providing the data block currently being read to the host if the currently being read data block does not follow a bad data block).

f. In column 8, lines 50-55, Stolowitz discloses that once the data from the last drive enters the pipeline, the accumulator will be holding the data from the missing drive. This result is transferred to a hold latch, and when the missing word in the pipeline from the failed drive is reached, the contents of the hold latch

is substituted in place of the pipeline contents (if one of the data blocks is bad, storing the good data blocks following the bad block in sequential order).

g. In column 8, lines 42-48, Stolowitz discloses that to reconstruct missing data in the event of any single drive failure, the serialized read data stream is passed through an N+1 stage pipeline register. To begin, a word from the first drive is loaded into an accumulator and into the pipeline. As the next data word enters the pipeline from the next drive, it is XORed with the first word and the result stored in an accumulator.

h. In column 8, lines 50-55, Stolowitz discloses that once the data from the last drive enters the pipeline, the accumulator will be holding the data from the missing drive (reading the parity block from the magnetic tape after all of the data blocks have been read).

i. In column 8, lines 48-55, Stolowitz discloses that the accumulating process is repeated for each subsequent drive except that data from the failed drive is ignored. Once the data from the last (redundant) drive enters the pipeline (reading the parity block from the parity storage element), the accumulator will be holding the data from the missing drive. This result is transferred to a hold latch, and when the missing word in the pipeline from the failed drive is reached, the contents of the hold latch is substituted in place of the pipeline contents (if one of the data blocks is bad, reconstructing the bad data block from the accumulated parity of the good data blocks and the parity block in order to form a reconstructed good data block; providing the reconstructed good data block to

the host; and providing the stored good data blocks to the host in sequential order after the reconstructed good data block has been provided to the host).

j. In column 8, lines 42-44, Stolowitz discloses an N+1 stage pipeline register (a buffer for storing the good data blocks read by the controller after the bad data block until the controller reconstructs the bad data block to preserve ordering of the data blocks during reading).

Referring to claim 13, in column 8, lines 42-48, Stolowitz discloses that to reconstruct missing data in the event of any single drive failure, the serialized read data stream is passed through an N+1 stage pipeline register. To begin, a word from the first drive is loaded into an accumulator and into the pipeline. As the next data word enters the pipeline from the next drive, it is XORed with the first word and the result stored in an accumulator (accumulating parity of the good data blocks includes exclusive ORing the parity of the good data blocks read prior to the good data block currently being read with the good data block currently being read).

Referring to claim 14, in column 8, lines 48-55, Stolowitz discloses that the accumulating process is repeated for each subsequent drive except that data from the failed drive is ignored. Once the data from the last (redundant) drive enters the pipeline, the accumulator will be holding the data from the missing drive. This result is transferred to a hold latch, and when the missing word in the pipeline from the failed drive is reached, the contents of the hold latch is substituted in place of the pipeline contents (reconstructing a bad data block includes exclusive ORing the accumulated parity of the good data blocks and the parity block).

Referring to claim 17, in column 8, lines 42-48, Stolowitz discloses that to reconstruct missing data in the event of any single drive failure, the serialized read data stream is passed through an N+1 stage pipeline register. To begin, a word from the first drive is loaded into an accumulator and into the pipeline. As the next data word enters the pipeline from the next drive, it is XORed with the first word and the result stored in an accumulator (the parity accumulator accumulates parity of the good data blocks by exclusive ORing the parity of the good data blocks read prior to the good data block currently being read with the good data block currently being read).

Referring to claim 18, in column 8, lines 48-55, Stolowitz discloses that the accumulating process is repeated for each subsequent drive except that data from the failed drive is ignored. Once the data from the last (redundant) drive enters the pipeline, the accumulator will be holding the data from the missing drive. This result is transferred to a hold latch, and when the missing word in the pipeline from the failed drive is reached, the contents of the hold latch is substituted in place of the pipeline contents (reconstructing a bad data block includes exclusive ORing the accumulated parity of the good data blocks and the parity block).

Response to Arguments

5. Applicant's arguments filed April 7, 2003 have been fully considered but they are not persuasive.

6. On page 7, under section 3. The Claimed Invention Compared to Stolowitz and White, the Applicant argues, "The claimed invention generally differs from any combination of Stolowitz and IBM in that the claimed invention is directed to an

implementation of RAIT on a track of a single magnetic tape." The Examiner would appreciate an explanation of how a Redundant Array of Inexpensive/Independent Tapes (RAIT) is capable of being on a **single** tape.

7. On pages 7-8, under section 3. The Claimed Invention Compared to Stolowitz and White, the Applicant argues, "White teaches the use of an error-correction code (ECC) in some of the blocks of a segment in a track. An ECC is generally implemented by splitting data of data blocks at the bit level and then spread over a number of blocks (such as eight of the thirty blocks in a segment as disclosed by White). As such, some of the blocks contain both data and the ECC. Typically, a Hamming code is used to calculate the ECC from the data bits. Accordingly, White does not teach or suggest data blocks and a parity block serially arranged on a track of the magnetic tape with the parity block following the data blocks. In contrast, White teaches blocks serially arranged on a magnetic tape track with some of the blocks being data blocks and some of the blocks being data and ECC blocks. As such, if a block containing both data and the ECC were unreadable, then it is not clear as to how White would be able to construct the data in this unreadable block." The Examiner respectfully disagrees. First, the Examiner would appreciate having a copy of the reference the Applicant used to explain an error-correction code. Second, in column 4, line 15, Price, U.S. Patent 3,755,779, discloses *an input ECC (parity check digit) field*. Contrary to the Applicant's argument, ECC and parity is used interchangeably. Third, White would reconstruct the data with error-correction routines using the EC codes appended to each data block as stated on page 177 of How Computers Work. Since ECC bits are considered parity

bits, the error-correction routines would include reconstructing the data through the use of parity.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael C Maskulinski whose telephone number is (703) 308-6674. The examiner can normally be reached on Mon-Thu 7:30-5 and Fri. 7:30-4 (second Fri.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert W Beausoliel can be reached on (703) 305-9713. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-7239 for regular communications and (703) 746-7238 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

MM
May 27, 2003

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